INSTRUCTION MANUAL

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Tenney
ENGINEERING, INC.

The Largest and Most Experienced Manufacturer of High Technology Environmental Test Equipment

OPERATING INSTRUCTIONS

TENNEY DIGITENN

Enclosed

A Word to the New User
Instructions
Completed Sample Program Form
4 Program Work Sheets
Calibration for 140A Bridgeboard
Calibration for 172 or 173 Bridgeboard

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A WORD TO THE NEW USER

Like a new hand-held calculator or any other microprocessor instrument, DigiTenn may seem a little confusing the first time you address it. But DigiTenn, like a multifunction calculator, is really simple to operate once you acquire its feel. If this instruction manual looks forbidding at first blush, don't fret. Read it, then spend a few hours practicing hands-on operation. After entering and verifying several programs, you'll find DigiTenn as easy to use as any other modern digital instrument.

TENNEY DIGITENN PROGRAMMER INSTRUCTIONS

TENNEY DIGITENN DESCRIBED

DigiTenn is a microprocessor-based programmer which, when interfaced with an environmental test chamber, does the following:

1. It furnishes one or more setpoint signals to the chamber's controller or controllers. For example, in its most popular application, DigiTenn provides temperature and humidity setpoint logic. In this capacity it performs the same function as a cam programmer.

2. Optionally, the instrument furnishes one or more on-off event signals to the chamber. These signals are used to initiate secondary functions. For example, they may energize specimens under test or auxiliary test equipment.

DigiTenn, in itself, is not a temperature or humidity controller. It simply furnishes setpoint information to one or more controllers to which it is wired. Its on-off event signals are transmitted to relays which perform required functions.

In addition to functioning as a programmer, DigiTenn also furnishes manual setpoint information to the chamber's controllers. Where the instrument is used for setpoint determination, no separate manual temperature or humidity dial is needed or provided.

How DigiTenn is Addressed

1. The most common means of instructing the instrument is via the keyboard. The operator presses keys in prescribed sequences to enter such program information as temperature, time, and secondary on-off functions.

2. Optional means of entering complete pre-programmed information are:

a. A factory programmed plug-in permanent read-only memory (PROM).

b. Recorded on magnetic tape via an ASCII coded I/O enable chip. Magnetic tape is a standard option.

Note: If power to the instrument is interrupted, and the battery pack is discharged, a program which has been entered will be erased. On power interruption, with the battery delivering backup power, a PROM program must be manually restarted. Other programs (RAM stored)will hold during power interruption, and will then proceed if power returns before the battery expires.

USING THE DIGITENN

A "Power On - Program Erase" switch is located on the front panel. In the "Erase" position, this switch interrupts all power to the unit, including battery backup power, and volatile memory is erased.

You will use your programmer in four basic modes:

1. Manual mode directs the instrument to transmit keyed-in information directly to the temperature or humidity controllers. Thus, with test chamber operable, you might key in 75°C dry bulb and 65°C wet bulb. You can instruct DigiTenn to hold those parameters, continuing to transmit them to the controllers while you are keying a program. In this way, you can precondition the chamber prior to commencing a programmed run.

2. Program mode allows you to key-in desired parameters for the program. Use of this mode is analogous to cutting of the cam on a cam programmer. The test chamber does not respond to instructions keyed-in during programming. It does not respond until run mode is selected.

3. Verify mode might be called the "instant replay" mode. It is selected to verify what information you have keyed into the programmer. You can elect to verify as often as you like or as infrequently. For example, you can verify each time you key-in a parameter or you can wait until you have keyed-in a complete program and then verify. You can verify all the parameters or just a few selected ones.

4. Run mode does just what the name implies: it starts the program running. It is analogous to starting the cam motor on a cam programmer.

THE DISPLAY

Located above the keyboard, the 3-1/2 digit display indicates the parameters as they are being verified. It can also be instructed to display parameters while the program is in progress, or to indicate the real time of day. It will indicate workspace setpoint temperature, if instructed, but does not display actual workspace temperature. The display also flashes to indication when unit is in the Verify mode.

KEY FUNCTIONS

An incorrect entry generates an error signal, i.e. (-1).

The following describes the function of each key:

HOLD: Stops the program in progress. Pressing of the HOLD key interrupts progress of the program the same as stopping of a cam results in a pause in the mechanically programmed instrument. HOLD is a latching key, performing its function when latched in. To cease holding, you simply press the key a second time and unlatch.

UCE: Upper case enable, is the master switch which allows words, such as clear, enter, or run, to be keyed into the instrument. This is a latching key, performing its function when latched down.

SP1: Setpoint #1, enters or loads setpoint information, typically temperature, into the programmer. Numbers can be entered in 0.1 steps and will verify ±.2 in wide range and ±.1 in narrow range.

SP2: Setpoint #2, enters or loads setpoint information, typically humidity, into the programmer. (Where only one parameter is programmed, only SP1 is used.)

CYCLE: Determines the number of times a program is repeated, not counting the first. If a program is to be run 3 times, 2 cycles are selected.

The cycle switch is really a repeat switch, and the number entered will represent the number of times the cycle is to be repeated. If eight cycles are desired, then seven is entered for the "cycle" function.

NEXT STEP:

Enters the next program step when you are in the program enter mode, or displays the current step when in the program run mode.

SEC: seconds, enters seconds of time into a program segment when you are keying in a program. You cannot mix seconds, minutes and hours in any one program step. Time for the entire step must be in one type of time unit, for example, either 3 minutes or 180 seconds. Also, time must always be in whole integers, e.i. not 1.5 hours but 90 minutes.

MIN: Minutes, enters minutes of time into the program segment (see seconds).

HR: Hours, enters hours of time into the program segment (see seconds).

VERIFY/RET: Verify enables you to verify information which has been keyed into the programmer and return takes you out of the Verify mode. In verify, the display will flash.

E-ON: Event on, an option, enters or loads the command for a selected event to be energized. Typical would be the energizing of a vibrator.

E-OFF: Event off, turns off selected event.

TOD: Time-of-Day, enters the actual time of day. Time-of-Day is entered as a keyed number of required digits. The hour, minute and second keys are not used for this entry. Examples: 10:17 AM is keyed in as the number -1017; and 1:03 PM is keyed as 103. A minus(-) sign is keyed ahead of the number for AM.

CLR: Clear, performs two functions:

1. Clears the display.
2. Cancels the ENTER instruction or function. Always press the CLR key

immediately before pressing another key where you desire the number function rather than the word function.

Note: The CLR function is automatic when entering a program.

RUN: Starts the program after it has been keyed-in.

MAN: Manual, allows you to enter setpoints and events, time of Day and to operate the chamber manually.

PROG: Program, allows you to enter data such as setpoints, times and events into the program which you are arranging.

ENT: Enter, is pressed prior to the selection of any word function on the keyboard except CLR.

PROGRAM DEFINED

A program is comprised of from 1 to 51 steps. A step is one program segment consisting of: (1) setpoint(s), (2) a time to reach those setpoint(s) and (3) a next-step instruction. Other instructions which might be entered into a step are: (1) on or off events, (2) number of repeats (cycles) and (3) automatic time of day start.

Note: An event cannot be entered in the middle of a step. If an event is desired, for example, in the middle of a soak period, that period must be programmed as two steps. The event would be entered at the start of the second step.

Several types of next-step instruction can be entered. These are: (1) loop-back, (2) jump forward and (3) program end.

MANUAL MODE PROCEDURES

Step	Procedure	Visual Indication
1.	Apply power to the system. Allow 5 seconds for stabilization.	000
	Note: Setpoint outputs are automatically set to approximately ambient at the start.	
2.	Press UCE to open keyboard for selections.	UCE key latched.
3.	Press ENT, MAN to select manual mode.	000
	SET TIME OF DAY CLOCK	
	Note: Time of day is always entered in the Manual Mode. If a program is to have time of day start, the time is entered in step 1, but, to function, it is necessary that the manual mode have a running clock, i.e., a time of day entry.	
4.	Enter real time of day digits (hours and minutes) by numeric keys. Enter minus (-) ahead of the number for AM.	Time of day
5.	Press ENT, TOD to load time of day.	000
6.	To verify and display time of day, press ENT, VERIFY, TOD.	Time of day (Flashing)
7.	Press RET to return keyboard for next entry.	000
8.	To manually select setpoint outputs, press CLR, then numeric keys for desired setpoint.	Entered setpoint
9.	Press ENT, SP1 to select setpoint 1 output.	000

10.	For optional SP2 setpoint, repeat steps 8 and 9.	(See 8 & 9)
11.	To verify setpoint entry, press ENT, VERIFY, then SP1 or SP2.	Entered setpoint (Flashing)
12.	Press RET to return keyboard for next entry.	000
13.	To enter an event on or off, press CLR, then the numeric key corresponding to desired event (1 to 7).	Selected event.
14.	Press ENT, E-ON or E-OFF to select the desired on or off function	000
15.	To verify, press ENT, VERIFY. Press E-ON to display status of events 1 to 4. Press E-OFF to display events 5 to 7. If a number is displayed, then that event is on, i.e., the event relay is energized. Note: The above is a special verification using E-ON and E-OFF to display status of 7 events with 4-digit display device.	Numbers of channels on, zeros of channels off., (Flashing)
16.	Press RET.	000

PROGRAM MODE PROCEDURES

Before entering program, if you wish to be sure the DigiTenn is completely clear, set switch to PROGRAM ERASE position for 10 seconds and then set to power ON again.

To supersede or replace material already written into a step, simply enter new instructions directly over it. Enter 0 to delete a number entry.

Program mode is used to enter step, time, setpoint, event, cycle, and program sequence. These steps must be entered prior to placing the instrument in run mode.

If a time is not entered for a step, that step is automatically one second long.

Always start a program with a step having no time entered. Enter desired start temperature (or humidity) in this first one second step. Now, setpoint will ramp to the value of this step in one second, fixing the starting setpoint of the program.

Step	Procedure	Visual Indication
	Program Step Selection (Be sure UCE is latched.)	
1.	To enter the program, press RET, ENT, MAN	000
2.	Press CLR; press the starting step number.	Selected step.
3.	Press ENT, PROG, to load the starting point.	Selected starting step.
	Time to Reach Setpoint Selection	
1.	Press the numeric keys to enter seconds or minutes or hours. (Don't mix them.)	Selected time.
2.	Press ENT, then SEC or MIN or HRS to enter desired time.	Current step.
3.	To verify step time, press ENT, VERIFY, then SEC, MIN, HRS.	Step time (Flashing)
4.	Press RET.	Current step.
	Note: If no time entry is made, a one-second default time occurs when this point is reached in the run mode.	

Step	Procedure	Visual Indication
	Setpoint Selection	
1.	Press numeric keys for desired setpoint expressed in °C.	Entered setpoint
2.	Press ENT, then SP1 or SP2 to enter the desired setpoint into the program step.	Current step
3.	To verify setpoint entry, press ENT, VERIFY, SP1 or SP2.	Entered setpoint (Flashing)
4.	Press RET.	Current step.
	Event Selection	
1.	To enter events, press numeric key corresponding to event (1 to 7).	Selected event
2.	Press ENT, and either E-ON or E-OFF to select desired condition	Current step.
3.	Repeat steps 1 and 2 for each event desired.	(same as in 1 & 2)
4.	To verify, press ENT, VERIFY, then E-ON to display status of events 1 to 4; press E-OFF to display status of 5 to 7.	Numbers of channels on, zeros of channels off (Flashing)
5.	Press RET.	Current step
	Next Step Selection	
1.	To enter the next step instruction, press the next step number. The program may be looped back or jumped to a non-sequential step. Do not attempt to loop back to 000.	Next selected step.

Step	Procedure	Visual Indication
2.	Press ENT, NEXT STEP.	Current step
3.	To verify next step entry, press ENT, VERIFY, NEXT STEP.	Next selected step (Flashing)
4.	Press RET.	Current step.
	Program Advance Selection	
1.	To advance the program to the next step, press numeric value of next step.	Next selected step.
2.	Press ENT, PROG.	New current step

(Now proceed to make parameter entries as already described for time, setpoint(s), event, next step and program advance.)

HOW TO TERMINATE A PROGRAM

The program can be terminated on one of four ways:

(1) Hold at final step.

(2) loop back indefinitely.

(3) Repeat selected number of loops, then hold at final step.

(4) Turning the chamber off through activation of an event relay circuited for "chamber stop," or through other automatic switching provided as an option.

You have made all program entries and are in your final step entry. Do as follows:

Hold At Final Step

1. As the final entry in your last program step, press ENT, NEXT STEP.

Step	Procedure	Visual Indication
2.	To verify, press ENT, VERIFY, NEXT STEP.	Final program Step. (Flashing)
3.	Press RET.	Final program step.

Loop Back

When a loop back is called for, the program returns to the end of the selected loop back step. For example, if the programmer is directed to loop back to step 3, it will loop back to the end of step 3, immediately going to the start of step 4.

Looping limitation: Since there is only one counter in Digi-Tenn, it can count but one loop at a time. Therefore, a loop within a loop is allowable only if the outer loop is to repeat indefinitely.

1.	Press numeric key(s) corresponding to the desired previous step that you wish to loop back to. Then press ENT, NEXT STEP.	Current step
2.	To verify, press ENT, VERIFY, NEXT STEP	Desired previous step. (Flashing)
3.	Press RET.	Current step.

Repeat Selected Number of Loops; Hold at Final Step

1.	Press numeric key(s) corresponding to the desired previous step that you wish to loop back to. Then press ENT, NEXT STEP.	Current step

Step	Procedure	Visual Indication
2.	Press numeric key(s) corresponding to desired number of repeats of loop. (Maximum number of repeats is 255.)	No. of repeats
3.	Press ENT, CYCLE.	Current Step.
4.	Press next sequential program step.	New step number
5.	Press ENT, PROG.	New step number
6.	Press numeric keys for desired final setpoint	Final setpoint
7.	Press ENT, SP1 or SP2.	Current step number.
8.	Press ENT, NEXT STEP.	Current step.

HOW TO MANUALLY START A PROGRAM RUNNING

Step	Procedure	Visual Indication
1.	Press RET, ENT, MAN.	000
2.	Press CLR.	000
3.	Press numeric key(s) corresponding to starting step of program.	Selected starting step.
4.	Press ENT, RUN.	Present program step.
5.	Unlatch UCE.	Present program step.

HOW TO START A PROGRAM RUNNING BY THE CLOCK
(NOTE: PRESENT TOD MUST BE ENTERED PER PAGE 7

Step	Procedure	Visual Indication
1.	Press RET, ENT, MAN.	000

Step	Procedure	Visual Indication
2.	Press CLR.	000
3.	Press keys corresponding to starting step of program.	Selected starting step.
4.	Press ENT, PROG.	Selected starting step.
5.	Press desired time of start.	Time of start
6.	Press ENT, TOD.	Selected starting step.
7.	Press ENT, RUN.	Present program step.
8.	Unlatch UCE.	
9.	Program will start to run when TOD for start is reached.	

PROGRAM EXAMPLE

The following illustrates how to enter a program into the Digi-Tenn. As an example, we will enter the temperature time program shown in Figure 1. This program is an accelerated one, an entire single "loop" taking but 41 seconds. The loop is repeated two times, for a total of 3 cycles. This is analogous to running a cam programmer for three revolutions of the cam.

If you press the wrong numeric key, or the wrong display appears, simply press CLR, then enter the correct information. If you desire a correction after an entry is made, simply write over; the previous entry will be superseded.

Our reason for using a compressed program as a teaching tool is so that you can play it back, watching it progress from start to finish in a relatively short time.

When "playing back" your practice program, be sure its commands do not actuate the chamber's conditioning equipment. On a facility with push button mode switches, select OFF. Where the chamber has rocker or toggle switches, leave those switches open.

With this manual is a program form which has been entered with the sample program. Refer to it while studying the following programming procedure.

Proceed as follows. All keys are pressed in the order shown.

1. Latch UCE.

2. Press ENT, MAN.

3. Press CLR, 1, ENT, PROG.

You have selected 1 as the starting step in your program.

4. Press - (minus), 1, 9, ENT, SP1.

You have entered -19°C as your starting setpoint.

5. Press 2, ENT, NEXT STEP.

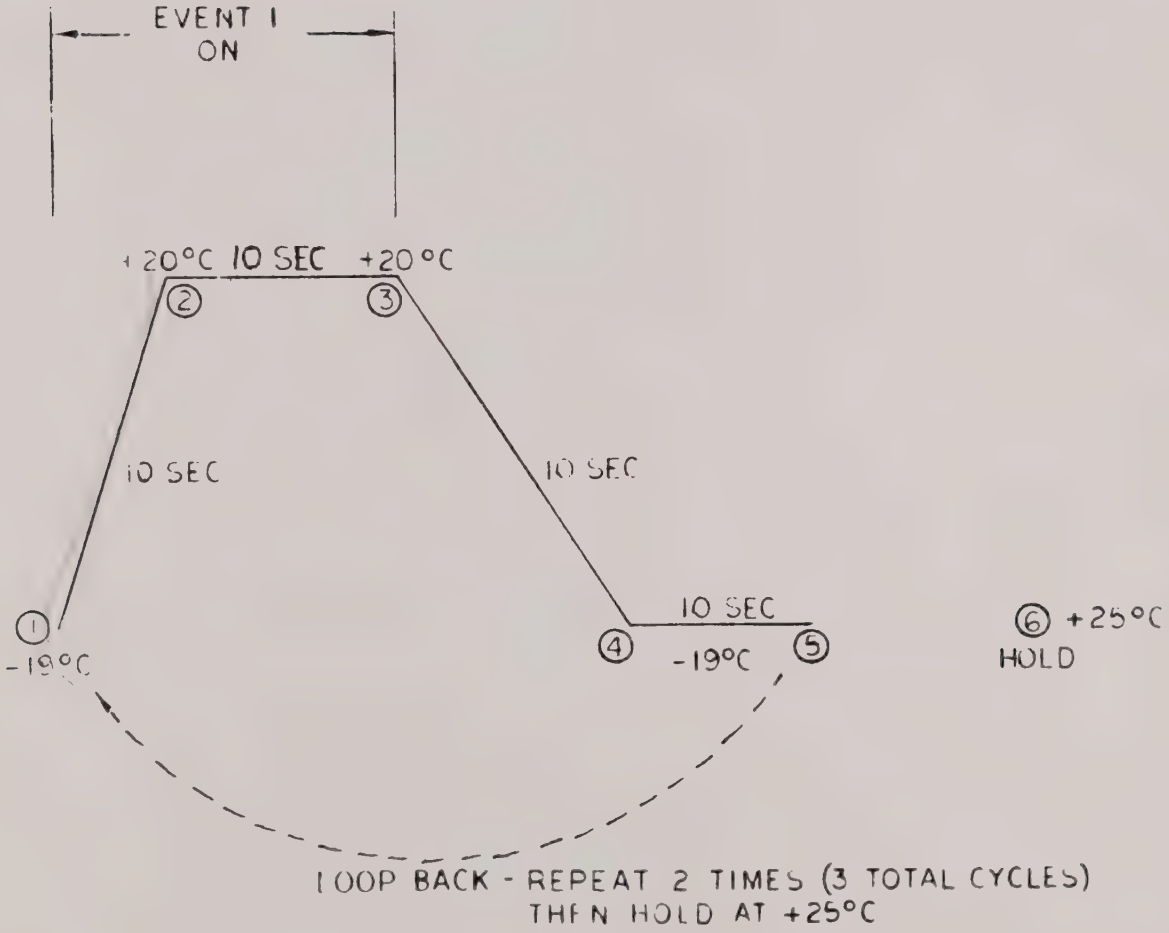
You have entered instructions telling DigiTenn to jump forward from Step 1 to Step 2.

6. Press 2, ENT, PROG.

You have selected 2 as the step you are about to program.

7. Press 10, ENT, SEC.

FIG 1: SAMPLE PROGRAM



NOTE: NOS. IN CIRCLE DENOTES PROGRAM STEPS.

You have now entered 10 seconds as the ramp time from Step 1 to Step 2.

8. Press 2, 0, ENT, SP1.

You have selected 20°C as setpoint for the end temperature of Step 2.

9. Press 1, ENT, E-ON.

You have now selected event #1 on.

10. Press 3, ENT, NEXT STEP.

11. Press 3, ENT, PROG.

12. Press 10, ENT, SEC.

13. Press 2, 0, ENT, SP1.

14. Press 1, ENT, E-ON.

15. Press 4, ENT, NEXT STEP.

16. Press 4, ENT, PROG.

17. Press 10, ENT, SEC.

18. Press -(minus), 1, 9, ENT, SP1.

19. Press 5, ENT, NEXT STEP.

20. Press 5, ENT, PROG.

21. Press 10, ENT, SEC.

22. Press -(minus), 1, 9, ENT, SP1.

23. Press 2, ENT, CYCLE.

You have entered an instruction to repeat the loop-back program two more times for a total of 3 cycles.

24. Press 1, ENT, NEXT STEP.

You have entered the loop-back instruction indicated in Figure 1.

25. Press 6, ENT, PROG.

26. Press 2, 5, ENT, SP1.

27. Press ENT, NEXT STEP.

You have entered an instruction to hold at +25°C at Step 6. This temperature will be held indefinitely.

HOW TO VERIFY THE PROGRAM EXAMPLE

Note: In the verify mode, the display will blink.

Before proceeding with verification, note this: You can correct mistakes in the program while you are verifying. To do so, proceed as follow:

1. Press RET. (Step number will be displayed.)

2. Enter the correct information. It will supersede the incorrect entry.

3. Press ENT, VERIFY, and continue with the verification of your program.

Verification Procedure

1. Latch UCE.

2. Press ENT, MAN.

3. Press CLR, 1, ENT, PROG.

4. Press ENT, VERIFY.

You may now verify each entry as follows. The proper display is shown .

Note: All displays flash while in Verify.

Press	Display (Flashing)
SP1	-19
NEXT STEP	2

You have completed verifying Step 1 and are ready to verify Step 2 and subsequent steps.

PROG	2
SP1	20
SEC	10
E-ON	1
NEXT STEP	3
PROG	3
SP1	20
SEC	10
E-ON	1
NEXT STEP	4
PROG	4
SP1	-19
SEC	10
E-ON	0 (means off)
NEXT STEP	5

Press	Display (Flashing)
PROG	5
SP1	-19
SEC	10
NEXT STEP	1
CYCLE	2
PROG	6
SP1	25
NEXT STEP	6

Verification is now complete.

IMPORTANT: Press RET key to return system from verify mode before running a program.

HOW TO MANUALLY START THE PROGRAM RUNNING

1. Latch in UCE.
2. Press ENT, MAN.
3. Press CLR, 1, ENT, RUN.
4. Unlatch UCE.

Unlatching UCE closes the keyboard, preventing inadvertent entries. The program starts running the instant you press RUN.

Watching the Program Run

As the program runs you may monitor the parameters on the display. Simply press the appropriate key and the display will indicate the status. For example, when you press SP1, the display will indicate setpoint temperature at that time in the program. When you

press HR, MIN, SEC, the display will show the number of hours, minutes and seconds which have elapased since the start of the program when you pressed RUN. When you press NEXT STEP, the display will show the current step.

HOW TO START A PROGRAM RUNNING BY THE CLOCK

DigiTenn can start a program running when it is unattended. Assume, for example, that you have entered a program and want it to start at 1:30 PM. Proceed as follows:

1. Latch UCE.
2. Press ENT, MAN.
3. Press CLR, 1, ENT, PROG.
4. Press CLR, 1, 3, 0, ENT, TOD.
5. Press CLR, 1, ENT, RUN.
6. Unlatch UCE.

GENERAL DESCRIPTION

Physical Unit

The digital programmer consists of a front panel and a circuit board. The 9-inch high by 12-inch wide front panel contains an 18-key keyboard and a 3-1/2 digital display. It is mounted in a cabinet via four mounting screws. The circuit board contains the power supply, microprocessor, memory, interface circuits and input/output connectors. There is a 22-pin, .156" spacing, connector to provide the input, output signals and power required to operate the unit. The connector is

wired to a cabinet-mounted terminal board via a flat ribbon cable to facilitate removal. All external connections are made at the terminal board.

Functional Description

The digital programmer is designed to provide one or two, variable 0-5 VDC, analog output signals in response to a time sequenced program stored in the microprocessor random access memory (RAM). Provision is also made for seven on/off event channels which are also sequenced by the microprocessor to control 24 VDC external relays or lamp loads.

Figure 2 shows a simplified block diagram of the unit. The 18-key keyboard is used for program entry, mode selection and monitor selection of the program parameters. A 3-1/2 digit display is provided to monitor program entry and operating parameters.

The microprocessor receives instructions from a read only memory (ROM) and the random access memory (RAM) to control the setpoint and event output channels. The ROM memory provides non-alterable instructions which are used to control the sequencing and entry of program parameters in the RAM memory. The RAM memory stores the program parameters entered by the operator via the keyboard. An optional programmable read only memory (PROM) can be sued for storage of program parameters.

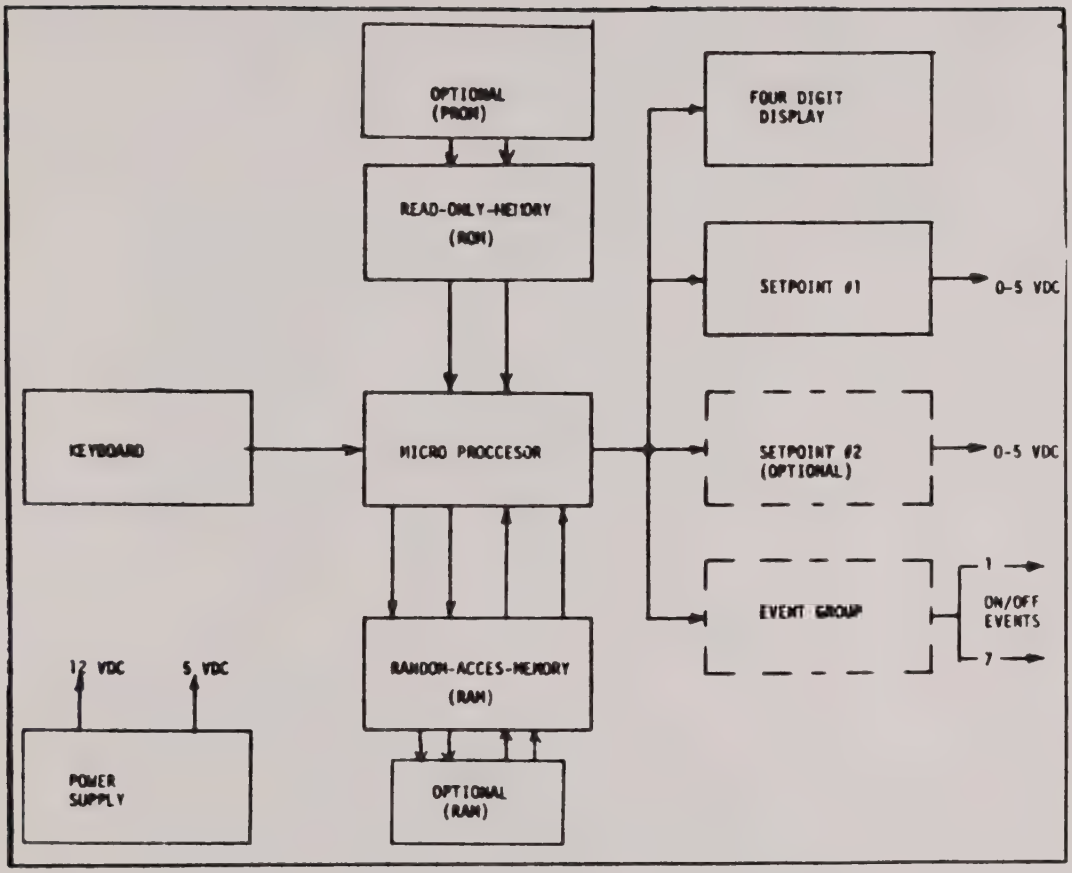


Figure 2 Functional Block Diagram

Overall Specifications

Inputs

Keyboard	18 key function/data entry
Remote	Range select

Output

Setpoints

SP1	0-5 VDC into 500 ohm setpoint
	(-100 to ±200 or -20 to +100 jumper selectable)

SP2 (optional)	0-5 VDC (-20 to +100 only)
Events	Seven open collector (24V @ 75 ma) for interface to remote relay coils.
Power Requirements	120/240 VAC +10% - 15%, 50/60 Hz, 40 VA
Maximum Power Interruption	100 milliseconds (unit clears and resets to ambient temp)
Environmental	Operating temperature 0-50°C Storage temperature -25 to 85°C Humidity 0 to 90% RH non-condensing

THEORY OF OPERATION

Overall Functional Operation

Figure 3 shows the overall block diagram of the major functional sections of the programmer. The following paragraphs provide a functional description of each basic section.

A. Keyboard and Keyboard Buffer - The keyboard consists of 18 pushbutton keys. The HOLD and UCE keys are latching type. The keyboard buffer provides the binary coded input to the microprocessor in response to the keyboard operations. The keyboard provides the means to select the functional modes of the unit, enter program parameters and select parameters for verification.

B. Display and Decoder - The display consists of four, seven segment, incandescent decimal digit indicators. The three least

significant digit displays are capable of displaying the digits 0-9. The most significant digit displays only decimal 1 and the minus (-) sign.

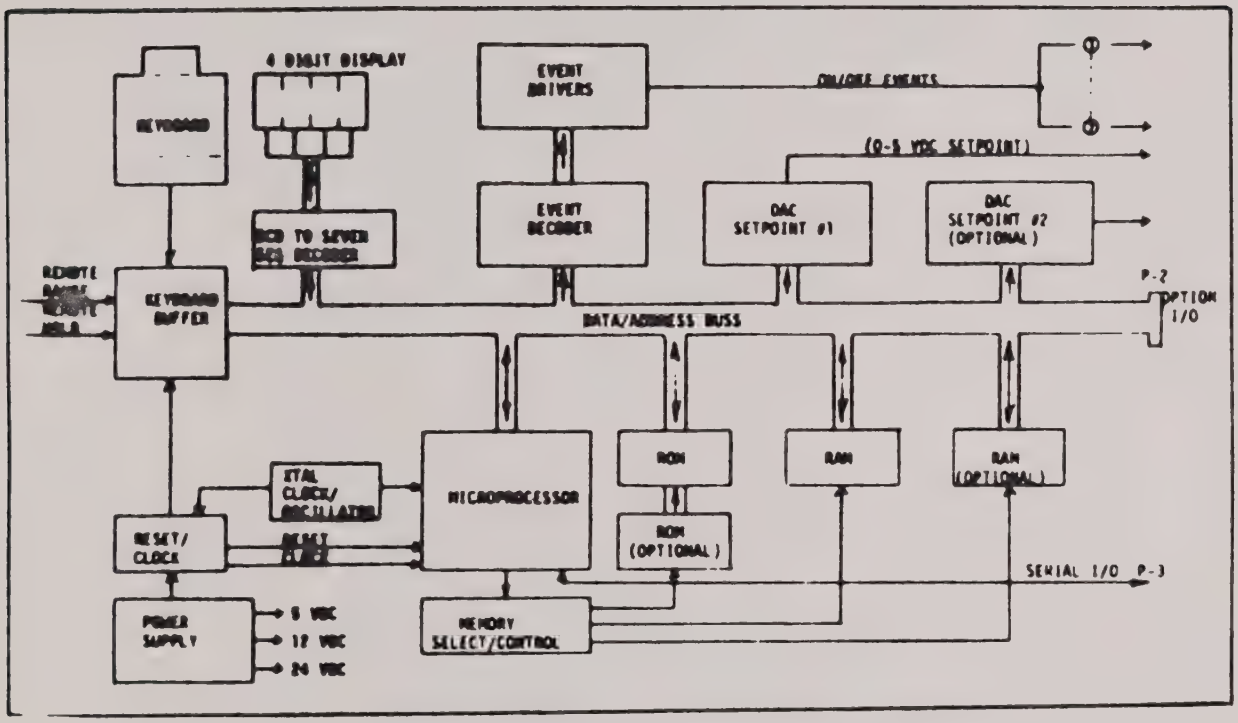


Figure 3 Overall Block Diagram

C. Microprocessor - The microprocessor receives instructions from the ROM memory and parameter data from the RAM memory and provides binary coded analog output data to the setpoint DA converters. In addition, the microprocessor provides bit position encoded data to select and control the seven output event channels. The BCD outputs applied to the display decoder permits the data inputs and outputs to be displayed.

D. Clock Oscillator - The clock oscillator provides the basic operating pulses required to operate the microprocessor. A reset counter is provided to set the microprocessor to an initial state when power is first applied to the unit. Included in the reset circuits is a low power detector which will reset the system should the power supply output go below 4.5 VDC.

E. ROM Memory - The read only memory contains the operational program required to sequence and control the programmer. The program steps are permanently encoded at the time of manufacture and cannot be altered. The contents of ROM memory is not destroyed when input power is removed from the system. The basic ROM stores 2048 eight-bit bytes.

F. RAM Memory - The random access memory is used to store the program parameters which are entered during the program mode of operation. This memory is erased when power is removed from the unit. The basic RAM contains 256 8-bit bytes. An optional RAM can be added to increase the storage capacity to 512 bytes.

G. Event Drivers and Decoders - The event drivers and decoders receive bit position encoded bytes from the microprocessor and translate the byte to turn on or off the seven event channels.

H. Setpoint DAC and Driver Circuits - These circuits are provided to translate the microprocessor digital setpoint output and

provide a 0 - 5 VDC setpoint analog control signal.

I. Memory Select/Control - Decodes device addresses.

MAINTENANCE

General

The following paragraphs describe the routine maintenance, trouble-shooting procedures and adjustments required for the unit.

Routine Maintenance

The unit requires no special maintenance on a schedule basis. The operator should periodically wipe the front panel clean of accumulated dust and dirt.

Trouble-Shooting

If a malfunction occurs the maintenance personnel should systematically attempt to isolate the problem within the system where the programmer is operating. If it is determined that the programmer is at fault use the procedures in Table A to attempt to isolate the cause. The programmer board is considered non-repairable and should be returned to the factory if a component failure is detected.

Adjustments

Reset - The RESET control potentiometer, P-1, is factory set to cause a reset if the power supply DC output drops below 4.5 VDC. If readjustment is required proceed as follows:

1. Attach Digital VOM to the 0-5 VDC scale and probe RESET wiper.

2. Apply power and adjust RESET potentiometer for a 4.5 V on wiper to 4.5 V to pin 3.

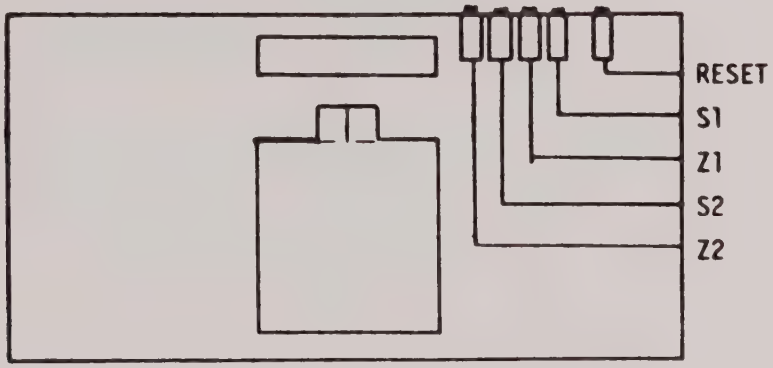


Figure 4 Circuit Adjustments

Table A Programmer Trouble-Shooting Procedures

SYMPTOM		
No indicators lighted on screen	1. No input power.	1. Check source and main fuse or circuit breaker.
	2. Power supply component failure.	2. Replace circuit board.
Improper setpoint output	1. Program error.	1. Verify program in manual mode.
	2. Circuit malfunction.	2. Replace programmer.
Improper event output.	1. Program error.	1. Verify program in manual mode. Reprogram.
	2. Circuit malfunction.	2. Replace programmer.

OPERATING DIGITENN WITH A PROM

In order to allow the internal PROM to determine the DigiTenn program, the operator selects: CLR, ENT, MAN, 52, ENT, RUN.

DIGITENN & WATLOW SYSTEM CALIBRATION
AJ, AK, AG, AH Controllers w/140A Bridgeboards

Equipment Required: Deviation Meter
Digital Volt Meter
Millivolt Supply

Preparation
- Wire in deviation meter, if not part of installation _____
- Disconnect HumiTenn from bridgeboard & replace with a Millivolt source _____
- Confirm calibration of DigiTenn output 0-5 VDC for full range _____

TURN ON POWER

1. Enter & verify manual mode setpoint into DigiTenn for 0% R.H. _____
2. Apply 0 millivolts to input terminals on humidity controller bridgeboard (140 or 140A) _____
3. Adjust Z2 POT on DGT to center deviation meter _____
4. Enter & verify into DGT 100% R.H. _____
5. Apply 500 millivolts (.5 volts) to input terminals on humidity controller bridgeboard (140 or 140A) _____
6. Adjust S2 POT on DGT to center deviation meter. _____
7. Repeat above steps until no further adjustment is necessary. _____

NOTE: Z2 & S2 POTS are refered to here since channel 2 is usually used for humidity control.

DIGITENN & WATLOW SYSTEM CALIBRATION
AG, AH, AJ, AK Controllers w/172 or 173 Bridgeboards

Equipment Required: Deviation Meter
Decade Resistance Box
0 to 10 VDC digital meter (read to ±.002 volt)

Preparation - Replace sensor with decade box _____

- Wire in deviation meter, if not part of installation _____

- Confirm calibration of DigiTenn output (.5 - 4.5 VDC for full range) _____

- Confirm range of controller to be calibrated: -100 to +199.9°C or -20 to +100°C. _____

- TURN POWER ON

1. Enter & verify manual mode setpoint into DigiTenn for -70°C (for wide range inst.)
   or
   0°C (for narrow range inst.) _____

2. Enter corresponding sensor resistance value 71.87 ohm (-70°C)
   or
   100 ohms (0°C) _____

3. Adjust zero pot for channel 1 or 2 as required (Z1 or Z2)until deviation meter is centered _____

4. Enter & verify into DigiTenn 170°C (for wide range inst.)
   or
   65°C (for narrow range inst.) _____

5. Enter corresponding sensor resistance value
   165.88 ohms (170°C)

   or

   125.6 ohms (65°C)

6. Adjust span pot for channel 1 or 2 as required
   (S1 or S2) until deviation meter is centered

7. Repeat above steps until no further adjustment
   is necessary

PROGRAM FORM (Completed in accordance with example program)

Turn Power On. Press UCE (latched-in), RET, ENT, MAN, CLR

Step	Time	Temperature (Parameter #1)	Parameter #2	Repeats	Events On	Procedure
o, ENT, PROG	no, ENT, SEC	no, ENT, SP1	no, ENT, SP2	no, ENT, CYCLE	no, ENT, E-ON	no, ENT, NEXT STEP
1	--	-19		--	--	2
2	10	20		--	1	3
3	10	20		--	1	4
4	10	-19		--	--	5
5	10	-19		2	--	1
6	--	25		--	--	6

DigiTemp

PROGRAM FORM

Turn Power On. Press UCE (latched-in), RET, ENT, MAN, CLR

Step	Time	Temperature (Parameter #1)	Parameter #2	Repeats	Events On	Procedure
no, ENT, PROG	no, ENT	no, ENT, SP1	no, ENT, SP2	no, ENT, CYCLE	no, ENT, E-ON	no, ENT, NEXT STEP

DigiTenn

PROGRAM FORM

Turn Power On. Press UCE (latched-in), RET, ENT, MAN, CLR

Step	Time	Temperature (Parameter #1)	Parameter #2	Repeats	Events On	Procedure
no, ENT, PROG	no, ENT	no, ENT, SP1	no, ENT, SP2	no, ENT, CYCLE	no, ENT, E-ON	no, ENT, NEXT STEP

DigiTemp

PROGRAM FORM

Turn Power On. Press UCE (latched-in), RET, ENT, MAN, CLR

Step	Time	Temperature (Parameter #1)	Parameter #2	Repeats	Events On	Procedure
no, ENT, PROG	no, ENT	no, ENT, SP1	no, ENT, SP2	no, ENT, CYCLE	no, ENT, E-ON	no, ENT, NEXT STEP

DigiTemp

PROGRAM FORM

Turn Power On. Press UCE (latched-in), RET, ENT, MAN, CLR

Step	Time	Temperature (Parameter #1)	Parameter #2	Repeats	Events On	Procedure
no, ENT, PROG	no, ENT	no, ENT, SP1	no, ENT, SP2	no, ENT, CYCLE	no, ENT, E-ON	no, ENT, NEXT STEP

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